IPM

Integrated Pest Management for sports fields

SUSTAINING A HIGH QUALITY TURFGRASS STAND requires a well integrated pest management program. Integrated pest management will not only provide effective pest prevention and control, but it will also reduce maintenance costs and management impacts on the surround environment. This article will highlight some of the warm and cool season turfgrass species and cultivars available for sports turf management, the cultivation practices necessary to sustain these grasses at a competitive level, and finally proper pest monitoring, detection and control methods.

SPECIES AND CULTIVAR SELECTION

Field managers in the cool season zone typically use Kentucky bluegrass because of its rhizomatous growth habit, which stabilizes the soil and allows for vegetative recovery after traffic. National Turfgrass Evaluation Program (NTEP) research conducted from 2006 to 2010 determined that 'Bewitched', 'Avid', 'Diva', 'Everest', and 'Nuchicago' provide improved wear tolerance. Results also determined that 'Belissimo', 'Empire' and 'Mystere' provided improved dollar spot tolerance, while 'Hampton', 'Juliet', 'Madison' and 'STR 2485' produced increased resistance to rust.

Field managers in the warm season and transition zone will likely use hybrid bermudagrass, which is known for its aggressive stoloniferous and rhizomatous growth habit when temperatures reach and exceed 80° F (Image 1). Some tried and true bermudagrass hybrids include 'Tifway,' the industry standard and oldest hybrid bermudagrass, 'TifSport,' known for its spring green-up, resistance to mole crickets and improved cold tolerance, 'Celebration,' an aggressive hybrid with improved wear tolerance, and 'Patriot,' which has excellent cold tolerance and improved resistance to spring dead spot. Some recently released hybrids include 'NorthBridge' and 'TifGrand' bermudagrass. NorthBridge was selected for its exceptional cold tolerance and excellent establishment rates. TifGrand provides improved fall color retention and relatively low nitrogen requirements.

>> **IMAGE 1:** Abraham Baldwin Agricultural College baseball field, Tifton, GA. Photo courtesy of Jeff Kilgore.

MOWING

Increasing your mowing height and frequency are important aspects when designing a well integrated pest management program. Increasing your mowing height will minimize the encroachment of invasive weeds such as crabgrass, dandelion and white clover. Increasing mowing heights will also increase rooting depth and, subsequently, increase turfgrass tolerance to stresses such as drought, insects and pathogens. Field managers should increase their mowing heights during the summer months, when the potential for heat stress is high and field use is minimal, and then gradually decrease the height prior to the fall sports season. Some general seasonal mowing height recommendations for Kentucky bluegrass are 3 inches during the summer, gradually reduced to 1.5 inches before the start of the athletic season (Image 2). Hybrid bermudagrass on the

>> **IMAGE 2:** Mowing (top) and irrigating (bottom) Kentucky bluegrass before the start of the 2008 Olympic Games in Beijing, China. Photos courtesy of Alec Kowalewski.

other hand is often maintained at heights as low as 0.5 inches on athletic fields.

Increased mowing frequencies have also been shown to improve turfgrass health and vigor. For instance, simply increasing mowing frequency from once to twice per week has been shown to improve cover, surface strength and wear tolerance, all import factors when trying to provide a high quality playing surface that is resistant to weed encroachment.

FERTILIZATION

When developing a fertilization plan for athletic fields, consider the environmental conditions in which your turfgrass thrives. Fertilize Kentucky bluegrass at increased rates (1.0-1.5 lbs N/1,000 ft^2/month) in the spring and autumn, and decreased rates (0.5-1.0 lbs N/1,000 ft^2/month) throughout the summer, totaling 3-5 lbs N/1,000 ft^2/year. Bermudagrass, because it is a warm season turf, will require relatively high application rates (1.0-1.5 lbs N/1,000 ft^2/month) during the summer and relatively light application rates (0.5-1.0 lbs N/1,000 ft^2/month) in the spring and fall, totaling 5-6 lbs N/1,000 ft^2/year.

Weeds that indicate nutrient deficiencies include white clover and common dandelion. Dollar spot and rust thrive in nitrogen deficient turfgrass, therefore, a light application of a quick release fertilizer high in nitrogen, such as urea (46-0-0) or ammonium nitrate (34-0-0), is often prescribed. However, brown patch and *Pythium* blight thrive when high nitrogen levels are combined with poor drainage, humidity and heat stress. A fertilizer application during these circumstances would only increase disease severity.

It is advantageous to select complete fertilizers containing relatively high concentrations of nitrogen (N), low concentrations of phosphors (P) and moderate levels of potassium (K), a ratio of approximately 4N-1P-2K. Apply controlled release fertilizers in the summer months when microbial activity and the potential for fertilizer burn is high and apply quick release fertilizers high in nitrogen (applied at a maximum of 0.5 lbs N/1,000 ft^2/application) in the spring and/or fall when rapid turfgrass recovery is required between sporting events.

IRRIGATION

Environmental conditions and turfgrass species are often intertwined factors when making irrigation adjustments throughout the seasons. Cool season turfgrass will likely require more frequent irrigation during periods of drought stress when root necrosis occurs (Image 2). It is important to note that diseases like *Pythium* blight and brown patch thrive in poorly drained, over-irrigated soils, while dollar spot thrives on turfgrass with prolonged periods of leaf wetness. Moss and algae are often signs of over-irrigation and applications should be reduced when present. Annual bluegrass is often a result of over-irrigation, particularly when coupled with over-fertilization.

On the other hand, because warm season grasses, like bermudagrass, tolerate relatively high atmospheric temperatures and produce extremely deep rooting, less frequent irrigation can be tolerated. Deep and infrequent irrigation will promote deeper rooting, particularly when the surface is allowed to dry between irrigation. Allowing the surface to dry between irrigation events will decrease the potential of disease associated with over-irrigation and prolonged period of leaf wetness, but also increases the potential for development of drought stress. Therefore, managers using the deep and infrequent irrigation regime should regularly monitor for drought stress and localized dry spot.

CULTIVATION

Turfgrass root growth can be maximized and soil organic matter can be minimized with soil cultivation. Soil compaction causes reduced root growth, poor drainage and, ultimately, increases susceptibility to disease and weed encroachment. Weeds associated with compacted soils include knotweed and goosegrass.

Excessive organic matter accumulation can cause decreased drainage and rooting, and increased disease activity. The vast majority of infectious turfgrass pathogens can survive on organic matter when the turfgrass is healthy, which increases the potential for infection during periods of adverse environmental conditions. Cultivation practices that reduce organic matter accumula-

Table 1: Herbicides and their intended strategy of use for management of annual broadleaf and grassy weeds in cool season and warm season turfgrass, table developed by Aaron Hathaway.

	Cool season turf	Warm season turf	Strategy
Annual broadleaves	carfentrazone (burndown), isoxaben (preemergence)	carfentrazone (burndown)	Control before they produce and disseminate seed
Annual grasses	quinclorac for crabgrass, fenoxyprop for goosegrass (postemergence)	quinclorac (postemergence); numerous products (preemergence)	Apply postemergence early in growth stage if possible
Annual bluegrass	ethofumesate, bispyribac sodium, mesotrione (postemergence)	pronamide, (preemergence); trifloxysulfuron-sodium, foramsulfuron (postemergence)	Be prepared for turfgrass and annual bluegrass injury
	paclobutrazol, flurprimidol (plant growth regulators)		**Caution:** apply only when warm season turfs are growing vigorously; do not apply 6-8 weeks prior to or during field use as it will halt growth

>> **IMAGE 3:** Cultivation equipment that remove excessive organic matter accumulation include implements such as the Toro ProCore (top) and Graden (bottom). Photos courtesy of Alec Kowalewski.

tion include core cultivation and vertical mowing (Image 3). When developing a cultivation program managers should affect 15-20% of the surface area annually.

WEED MANAGEMENT

Annual broadleaves (e.g. prostrate knotweed and spurge) can be controlled with burndown products like carfentrazone because they lack the necessary root mass or carbohydrate reserves to reproduce the "burned" foliage (Table 1). These herbicides work very quickly and can be very useful on difficult to control weeds like prostrate knotweed, which thrives in compacted soils.

Annual grasses (e.g. crabgrass, goosegrass and foxtail) are most efficiently (low cost, highly effective) controlled with preemergence herbicides. However, the use of preemergence herbicides in cool season turf may not be an option if a manager is constantly interseeding to encourage full turf cover. With the loss of MSMA in turf, quinclorac has become a staple for postemergence crabgrass control, but it does not provide the same control on goosegrass.

Annual bluegrass thrives in cool weather conditions (i.e. winter in the warm season zone, and spring and fall in the cool season and transition zones) and is a prolific seeder even at low mowing heights (Image 9).

Actively monitor for annual bluegrass infiltration on athletic fields as spring seed

>> **IMAGE 9:** Annual bluegrass in hybrid bermudagrass emerging from winter dormancy in February, Tifton, GA (top) and annual bluegrass in Kentucky bluegrass at a minor league baseball field in April, Lansing, MI (bottom). Photos courtesy of Alec Kowalewski.

production will make this troublesome winter annual a troublesome part of the soil seed-bank if it isn't fought when it first infiltrates. For effective control of annual bluegrass, cool season turfgrass herbicides are usually applied in small doses and repeated at short intervals. Programs include more than one product type applied at differing portions of the growing season. For example, flurprimidol (a plant growth regulator) is applied in the spring, and then ethofumesate (postemergence herbicide) is applied the subsequent fall.

Herbicides provide excellent weed control, but timing, rate, and application intervals are of utmost importance. Application may interfere with cultural practices, turfgrass germination and growth, so learn to adapt and proceed with caution. Learn the traits of each active ingredient (AI) in herbicides as they are put in differing combinations more and more. Test new herbicides on practice fields or small portions of game fields to better understand their affects.

DISEASE MANAGEMENT

Spring dead spot is a serious disease of bermudagrass, especially in the transition zone. Fall infections predispose turf to winter kill. In the following spring, circular patches appear to remain dormant, while roots, rhizomes and stolons are sparse and

>> **IMAGE 4:** Foliar symptoms (top) and dark brown to black roots and rhizomes resulting from spring dead spot of bermudagrass. Photos courtesy of Alfredo Martinez.

>> **IMAGE 5:** Circular brown patches (top) and necrotic leaves (bottom) resulting for brown patch infestations. Photos courtesy of Lee Burpee and Alfredo Martinez

dark-colored (Image 4). The cool and moist conditions in autumn and spring promote disease development. Management practices that increase cold hardiness generally reduce disease incidence. Maintaining balanced fertility and proper thatch management will reduce disease activity while promoting healthy turfgrass. Field managers should also avoid late-season applications of nitrogen and make fall fungicide applications (i.e. azoxystrobin (Heritage), fluoxastrobin

(Disarm), myclobutanil (Eagle), thiophanate methyl (3336) among others).

Brown Patch and *Pythium* blight are often the most serious diseases on cool season grasses. Brown patch is a foliar blight resulting in necrotic leaves and circular brown patches up to 4-6 ft in diameter (Image 5). High humidity and temperatures, combined with excessive nitrogen levels increase disease activity and severity. To minimize disease severity avoid nitrogen application when the disease is active, allow the foliage to dry between irrigation events, and remove excessive organic matter with cultivation. There are many fungicides that will provide excellent control of brown patch. Check the labels for information.

Pythium blight starts as small, irregular spots, which initially appear dark and water-soaked (Image 6). Affected turfgrass collapses, appears oily and matted and dies rapidly. White, cottony mycelia may be evident early in the morning. *Pythium* blight is encouraged by hot-wet weather, which correlates to increased stress on the turf. Cultural practices for control of brown patch will also help to minimize *Pythium* development. Note that correct diagnosis is important because *Pythium* control requires specific fungicides, such as fosetyl-al (Aliette, Chipco signature) and/or mefenoxam (Subdue MAXX) among others.

INSECT MANAGEMENT

White grubs are the larvae of several species of scarab beetles and are typically the injurious stage to turf. Grubs are white, C-shaped insects that have three pairs of legs and a distinct, brown head. Common grubs affecting turf include chafers, May beetles, June beetles and Japanese beetles. Grubs feed on the turf roots, substantially compromising the stress tolerance of the above ground foliage. In heavy grub infestations, roots are pruned to the extent that the turfgrass withers and dies and can easily be pulled up.

Because grubs tend to be in clumped populations, it is important to look in several areas using a spade to check the root zone in the spring and fall (Image 7). Typically, 5 grubs per foot in un-irrigated turf and 15 in irrigated turf indicate the need for treatment. Turf under heavy traffic will be less tolerant of grub injury.

>> **IMAGE 6:** Signs (top) and symptoms (bottom) of *Pythium* blight. Photos courtesy of Lee Burpee.

>> **IMAGE 7:** Grub sampling using a flat edge shovel (top) and white grubs of Japanese beetle (bottom) collected in June. Photos courtesy of Alec Kowalewski.

Effective curative products for late instar control include trichlorfon (Dylox) or carbaryl (Sevin). Preventive applications can be very effective using imidacloprid (Merit), thiamethoxam (Meridian), or chloranthaniliprole (Acelepryn). Effective combination products, designed to control soil insects and surface feeders include, imidacloprid and bifenthrin (Allectus) or clothianidin and bifenthrin (Aloft). Sports

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turf managers should realize that some individuals do show pyrethroid (bifenthrin) skin sensitivity. The neonicotinoid insecticides used for grub control have very low mammalian toxicity while being very effective grubicides. During dry weather the turf should be irrigated prior to treatment to help the insecticide penetrate grass blades and dry thatch.

Armyworms, which are caterpillars of moths, are greenish when small, but become brown with several length wise stripes when fully grown at ½ inch. The adult is a mottled brownish-gray moth with a wingspan of nearly 1 ½ inches.

Irritant sampling with dish soap is particularly useful in detection and monitoring of armyworm, as well as mole crickets, cutworms, or sod webworm infestations (Image 8). The soap irritates sensitive soil-inhabiting pests causing them to quickly come to the surface. When using this monitoring method mix one ounce liquid detergent per gallon of water and apply to one square yard. For best results apply insecticide in the early evening when caterpillars are actively feeding on turfgrass. ■

>> IMAGE 8: Irritant sampling, using dish soap mixed in water (top), and mature, final instar, fall armyworm (botom) collected in early September. Photos courtesy of Alec Kowalewski.

Alex Kowalewski, is an assistant professor at Abraham Baldwin Agricultural College, Tifton, GA. Aaron Hathaway is a research assistant, Crop and Soil Science, Michigan State University. A. Martinez-Espinoza is an associate professor of Plant Pathology, University of Georgia-Griffin Campus. S. Kristine Braman is a professor of Entomology, University of Georgia-Griffin Campus.